

What is claimed is:

5/22/82
1. An optical fiber wiring apparatus, wherein are provided:
a wiring substrate on which optical fibers are wired;
a wiring head which guides said optical fibers to a lead
end thereof and forms an optical fiber path;

an optical fiber feed means which feeds said optical fiber
during the wiring operation into said optical fiber path of said
wiring head;

an optical fiber contact means, which brings an optical
fiber, which has been guided to said lead end of said wiring
head via said optical fiber path, and said wiring substrate into
contact;

an XY movement means, which moves said wiring substrate
and said wiring head relative to one another in the X and Y
directions in the state in which said optical fiber at said lead
end of said wiring head has been placed in contact with said
wiring substrate by said optical fiber contact means; and

an optical fiber affixing means, which successively
affixes, to said wiring substrate, said optical fiber which has
been brought into contact with said wiring substrate during
movement by said XY movement means.

2. An optical fiber wiring apparatus in accordance with claim
1, wherein

an optical fiber within an optical fiber path of said
wiring head is successively drawn out when the optical fiber

at the lead end of said wiring head is successively affixed by said optical fiber affixing means, and

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said optical fiber feed means feeds said optical fiber stocked in said optical fiber path which successively draws out optical fiber.

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3. An optical fiber wiring apparatus in accordance with claim 1, wherein

at least a lead end of said wiring head has a hemispherical shape and a guide groove which guides said optical fiber in the hemispherical part,

a pressure groove is formed which is connected to said guide groove and extends to said hemispherical part, and

said optical fiber is guided to the lead end of said wiring head via said guide groove and said pressure groove.

4. An optical fiber wiring apparatus in accordance with claim 1, wherein

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said wiring head has a lower end which smoothly widens in the downward direction and is provided with an optical fiber path in an inner part thereof which guides an optical fiber to the lead end thereof.

5. An optical fiber wiring apparatus in accordance with claim 2, wherein

said optical fiber feed means is provided with a deflection detection means for detecting deflection of said

optical fiber within said optical fiber path of said wiring head or in a path leading to this optical fiber path, and

a deflection maintaining means for maintaining the deflection within a predetermined range based on detection values of said deflection detection means.

6. An optical fiber wiring apparatus in accordance with claim 1, wherein

said optical fiber feed means feeds an amount of optical fiber necessary during various successively executed wirings successively into the optical fiber path of said wiring head.

7. An optical fiber wiring apparatus in accordance with claim 6, wherein

said optical fiber feed means is provided with a reverse rotation prevention means which prevents back feeding of said optical fiber and which conducts drawing out of the optical fiber in the direction of feeding without resistance.

8. An optical fiber wiring apparatus in accordance with claim 7, wherein

said reverse rotation prevention means is a one-way clutch.

9. An optical fiber wiring apparatus in accordance with claim 1, wherein

said optical fiber contacting means is provided with a Z axis actuator which displaces said wiring head in the Z axial direction, and displaces said wiring head in the direction of said wiring substrate and brings an optical fiber at the lead end of said wiring head into contact with said wiring substrate.

10. An optical fiber wiring apparatus in accordance with claim 9, wherein

a force with which said optical fiber contacting means brings said wiring substrate and said optical fiber at a lead end of said wiring head into contact is within a range of 9.8×10^{-2} (N) (10 gf) - 2.0 N (200 gf).

11. An optical fiber wiring apparatus in accordance with claim 1, wherein

at least a part within said optical fiber path of said wiring head which comes into contact with said optical fiber comprises a material having a lower coefficient of friction than said optical fiber.

12. An optical fiber wiring apparatus in accordance with claim 1, wherein

in said optical fiber path of said wiring head, at least a portion which guides said optical fiber to the lead end thereof is formed with a radius of curvature larger than the radius of curvature causing breakage of said optical fiber.

13. An optical fiber wiring apparatus in accordance with claim 3, wherein

a Z axial rotation means, which rotates said wiring head about the Z axis in accordance with a wiring pattern, and orients said pressure groove of said wiring head in a direction in which wiring is to be conducted during the wiring operation, is provided.

14. An optical fiber wiring apparatus in accordance with claim 13, wherein

said Z axial rotation means is provided with a rotational reference sensor for orienting said pressure groove of said wiring head in the direction in which wiring is to be conducted.

15. An optical fiber wiring apparatus in accordance with claim 1, wherein

an optical fiber cutting means for cutting said optical fiber to a predetermined length is provided.

16. An optical fiber wiring apparatus in accordance with claim 15, wherein

said optical fiber cutting means is provided with:

an optical fiber path into which said optical fiber is inserted,

a cutter disposed so as to be capable of movement in a direction crossing said optical fiber path, and

an electromagnetic slider which moves said cutter instantaneously in a direction crossing said optical fiber path.

17. An optical fiber wiring apparatus in accordance with claim 1, wherein

said XY movement means moves said wiring head and wiring substrate relative to one another so that said wiring head is positioned outside said wiring substrate;

said optical fiber feed means feeds a predetermined length of said optical fiber when said wiring head is positioned outside said wiring substrate, and

by means of this, a predetermined length of optical fiber is fed outside said wiring substrate.

18. An optical fiber wiring apparatus in accordance with claim 17, wherein

a table which supports said wiring substrate and which has drop holes in the vicinity of said wiring substrate support part is provided, and

a predetermined length of optical fiber is fed into said drop holes of said table and a predetermined length of optical fiber is fed out outside of said wiring substrate.

19. An optical fiber wiring apparatus which lays optical fibers down on a wiring substrate,

which is provided with a manipulator which is disposed in a plane which is approximately parallel to the surface of said wiring substrate in a movable manner, and which conducts the laying operation of the optical fibers on said wiring substrate, and

which manipulator is further provided with: an optical fiber feed means for feeding optical fibers,

a wiring mechanism for wiring, onto said wiring substrate, optical fibers fed by said optical fiber feed means;

a Z axial rotation mechanism which rotates about an axis approximately perpendicular to the surface of said wiring substrate and thereby changes the orientation of the wiring of said wiring mechanism; and

an optical fiber cutting means which cuts optical fiber fed by said optical fiber feed means.

20. An optical fiber wiring apparatus in accordance with claim 19, wherein

said wiring means is disposed so as to be movable in a direction of approach to or separation from said wiring substrate, and a wiring plunger is provided which presses said wiring substrate while guiding said optical fiber in a predetermined orientation, and

said optical fiber feed means and said wiring plunger are disposed so as to hold said optical fiber cutting means therebetween in the Z axial direction, and are disposed so as to be simultaneously rotatable by said Z axial rotation means.

21. A wiring method which conducts the wiring of an optical fiber onto a wiring substrate, wherein

the feeding of this optical fiber is adjusted by an optical fiber feed means so that the tension on the optical fiber is within a fixed range,

the optical fiber fed by the optical fiber feed means is wired onto the wiring substrate by a wiring means, and

the optical fiber is cut to the length required for the wiring by an optical fiber cutting means.

22. An optical fiber wiring method which employs an optical fiber wiring apparatus which is provided with a wiring substrate, a wiring head which applies an optical fiber to said wiring substrate with a predetermined force, and an optical fiber feed means which feeds stocked optical fiber, which apparatus moves said wiring substrate and said wiring head relative to one another in the XY directions and conducts wiring operations which form a desired optical fiber wiring pattern on said wiring substrate; wherein

an optical fiber of predetermined length is fed by said optical fiber feeding means, in a manner unrelated to the wiring, either before or after the wiring operation or both before and after the wiring operation ,and

an optical wiring board having optical fibers of a predetermined length connected to said wiring pattern either before or after said wiring pattern by means of the wiring

operation or both before and after said wiring pattern, is produced.

23. An optical fiber wiring method which employs an optical fiber wiring apparatus which is provided with a wiring substrate, a wiring head which is provided with an optical fiber path which guides an optical fiber to a lead end thereof and which applies said optical fiber guided to said lead end to said wiring substrate with a predetermined force, and an optical fiber feeding means which feeds stocked optical fiber, which apparatus moves said wiring substrate and said wiring head relative to one another in the XY directions and conducts a wiring operation which forms a predetermined optical fiber wiring pattern on said wiring substrate; wherein,

at the initiation of wiring, said wiring head is moved to a wiring initiation position, and

in the state in which said optical fiber has been guided to said lead end of said wiring head, this is pressed against said wiring substrate,

said wiring head is moved along said wiring pattern with respect to said wiring substrate, the required optical fiber is fed into said optical fiber path of said wiring head by said optical fiber feeding means, and wiring is conducted.

24. An optical fiber wiring method in which an optical fiber is laid on a wiring substrate by a wiring head, at least a lead end of which is formed with a spherical surface, which has

formed in a side surface part thereof a guide groove which guides an optical fiber to said spherical surface part, and which has a pressure groove which extends from said guide groove to the top part of said spherical surface part; wherein,

at the initiation of wiring, said wiring head is moved to a wiring initiation position,

an optical fiber is fitted into said pressure groove and is pressed against said wiring substrate,

said wiring head is moved along said wiring pattern with respect to said wiring substrate, and wiring is conducted.

25. An optical fiber wiring method in accordance with claim 24, wherein

when a wiring pattern to be wired is a curved pattern, said pressure groove of said wiring head is oriented in a direction at tangent to said wiring pattern.

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